

CLAIMS:

We claim

1. An apparatus having a plurality of sensors that monitor material properties of a liquid medium, said apparatus comprising:

a flow channel of predetermined shape and dimensions, said flow channel being a path for a flow of a liquid medium, whereby said liquid medium is contiguous with a surface of said flow channel;

a metal housing of predetermined shape and dimensions surrounding said flow channel, said metal housing comprising an upper half and a lower half that are contiguous;

a first plurality of sensor ports in said metal housing for providing a plurality of sensors access to said liquid medium;

a first recess of predetermined shape and dimensions in said lower half for receiving a first ceramic block of predetermined shape and size thereby creating an exposed planar surface of said first ceramic block that is contiguous with said flow channel;

a second recess of predetermined shape and dimensions in said upper half for receiving a second ceramic block of predetermined shape and size thereby creating an exposed surface of said second ceramic block that is contiguous with said flow channel, said second ceramic block disposed opposite and facing said first ceramic block;

a first lead electrode that is disposed on said exposed planar surface of said first ceramic block and a second lead electrode that is disposed on said exposed planar surface of said first ceramic block, said second lead electrode does not touch said first lead electrode;

a first multitude of finger electrodes of predetermined shape and dimensions, said first multitude of finger electrodes disposed on said exposed planar surface of said first ceramic block so that no finger electrode touches any other said finger electrode and so that said first multitude of finger electrodes is contiguous with said first lead electrode;

a second multitude of finger electrodes of predetermined shape and dimensions disposed on said exposed planar surface of said first ceramic block so that no said finger electrode touches any other said finger electrode and said second multitude of finger electrodes is contiguous with said second lead electrode, said first multitude of finger electrodes and said second multitude of finger electrodes are interleaved and alternately disposed means for forming interdigitating electrodes disposed on said exposed planar surface of said first ceramic block so that said first multitude of finger electrodes and said second multitude of finger electrodes are not touching;

a first detector means for measuring electrical admittance of said interdigitating electrodes, said detector means connected across said first lead electrode and said second lead electrode;

an interchange channel of predetermined shape and dimensions that is aligned with and contiguous with said flow channel and is sandwiched between said flow channel and machine means for pumping said liquid medium into said interchange channel, said interchange channel aligned with said machine means, whereby said interchange flow channel directs said flow of said liquid medium into said flow channel;

a metal adapter plate of predetermined shape and dimensions surrounding said interchange channel, said metal adapter plate sandwiched between said metal housing and said machine means for pumping said liquid medium, said metal

adapter plate contiguous with said metal housing and said machine means for pumping said liquid medium;

a first means for controlling temperature of said metal housing and said metal adapter plate and

a plurality of detector means for measuring responses from said plurality of sensors.

2. An apparatus in accordance with claim 1, wherein said flow channel has a cross sectional shape of a slit with a width that is greater than ten times a height of the flow channel.
3. An apparatus in accordance with claim 1, wherein a length of said flow channel is long enough to accommodate said plurality of sensor ports in said metal housing for forming a slit sample chamber with fixed height along the entire length of said flow channel.
4. An apparatus in accordance with claim 1, wherein said plurality of sensors is selected from a group comprising at least one of the following: a pressure sensor, and a temperature sensor, and an electric sensor, and a dielectric sensor, and an ultrasonic sensor, and an optical sensor, and a magnetic sensor, and a mechanical sensor, and a radiation sensor, and an ultraviolet absorption sensor, and an infrared absorption sensor, and a microscopy image sensor.
5. An apparatus in accordance with claim 1, wherein said finger electrodes of said interdigitating electrodes have an identical predetermined shape and dimension.
6. An apparatus in accordance with claim 5, wherein each said finger electrode is separated from its nearest neighbor by a predetermined identical distance so as to control a spatial definition of a fringing electric field inside said flow channel.

7. An apparatus in accordance with claim 6, wherein said interdigitating electrodes are oriented at a predetermined angle with respect to a flow direction of said liquid medium.
8. An apparatus in accordance with claim 6, wherein first interdigitating electrodes of first predetermined shape and dimension and angle with respect to said flow direction and second interdigitating electrodes of second predetermined shape and dimension and angle with respect to said flow direction are disposed on said exposed planar surface of said first ceramic block for producing a first fringing electric field and a second fringing electric field so that said first fringing electric field and said second fringing electric field have different directions and spatial definition.
9. An apparatus in accordance with claim 1, further including a lifting bolt means for removing said first ceramic block from said first recess in said lower half.
10. An apparatus in accordance with claim 1, further including an additional instrument sensor sector comprising a second plurality of sensor ports, said additional instrument sensor sector sandwiched between and contiguous with said metal adapter plate and said metal housing, said additional instrument sensor sector surrounding a sector channel that is aligned with said flow channel and said interchange flow channel.